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Fiscal decentralization and income convergence: evidence from Vietnam

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ABSTRACT

The question of regional per-capita income convergence has been widely investigated theoretically and empirically. This study reviews the relevant literature and considers the possible significance of fiscal decentralisation in the convergence process. Alternative indicators of fiscal decentralization are examined within a SDM model which also takes into account possible spatial interdependencies between neighbouring regions. The modelling suggests that fiscal decentralization does appear to play a significant role in the convergence process in Vietnam. Income inequality remains a challenging issue for policymakers to resolve, and if regional disparities can be reduced in part through fiscal decentralization, this is a significant finding for policy formulation.

KEYWORDS
Regional income convergence; fiscal decentralization

1. Introduction

The idea of convergence in economics (also known as the catch-up effect) relates generally to the hypothesis that poorer economies' per-capita incomes will tend to grow at faster rates than richer economies, resulting eventually in a convergence of per capita income levels. This paper focuses attention on convergence in the setting of regional per-capita income disparities in Vietnam, and the extent to which the ongoing fiscal decentralization policies may potentially impact on any tendency towards regional convergence in growth rates and per-capita income in that country.

From the mid-1980s, and extending from the Doi Moi reform period, the Vietnamese economy has been transformed from a highly centralized planned economy to one where the private sector plays an increasingly significant role alongside both directive and indicative planning on the part of the Government. This process has been characterized by significant public-sector reforms, particularly from the late 1990s, and as a result, Vietnam is moving towards higher political, administrative and fiscal decentralization (McCulloch, Malesky, and Duc 2013; World Bank 2017). Significantly, the State Budget Law implemented in 2002 has enabled the decentralization of key budget

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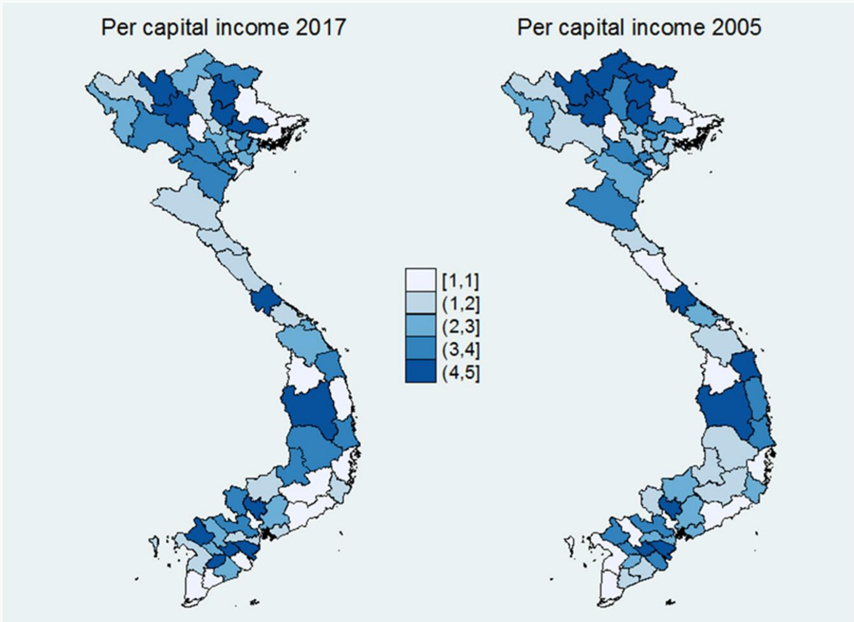

Figure 1. Geographical distribution of per capita income by percentile in 2005 and 2017.
Note: Five color-coded quintiles of per capita income per year, sorted into the poorest, second poorest, middle, second richest, and richest quintiles (Statistical Yearbook of Viet Nam).

and human resources responsibilities to local governments. Local governments account for over half of total government expenditure in Vietnam, spending close to 17 percent of GDP, which is high by international standards (World Bank 2015; World Bank 2017).

An association between income convergence associated with fiscal decentralization in Vietnam over recent years is suggested in Figure 1. Here we observe that during the period of decentralization, income per capita has been growing, while at the same time, income per capita disparity of the 63 provinces in Vietnam has been decreasing.

The extent to which decentralization, centered on the reforms outlined above, has contributed to regional income convergence is examined further in this paper.

Theoretical approaches to the income convergence question may be classified under four general categories; neoclassical growth theory, new or endogenous growth theory, new economic geography and spatial analytical approaches (Kalra and Thakur 2015). Predictions made on the basis of neoclassical growth theory framework, developed from Swan (1956) and Solow (1956, 1957), suggest that, if all regions share the same technology, savings propensity and population growth, we would observe a tendency towards the erosion of per-capita income differentials between regions or localities. This is often referred to in the literature as unconditional ('absolute') or 'sigma'-convergence. A tendency towards absolute convergence is sometimes seen to be reinforced by what Alexander Gerschenkron (1962) had termed the 'advantages of backwardness'.

An observed absence of absolute convergence across nations was a motivating factor in Paul Romer's (1986) contribution to the development of endogenous growth theory, which would suggest that absolute per-capita income convergence is unlikely to occur. The distinguishing characteristic of endogenous growth theory is the rejection of the notion of exogenous productivity growth, which instead is seen to be dependent upon a number of structural variables in the economy. This introduces the likelihood of multiple equilibria and the possibility of path-dependency, and hence the persistence of heterogeneity in per-capita income levels across nations and regions. This may also result in what has been termed ‘club convergence’, where per-capita income levels converge for groups of countries or regions on the basis of structural characteristics that are independent from initial conditions.[1] Endogenous growth theory is therefore, in part, supportive of a notion of conditional (‘relative’) or ‘beta’ convergence, which refers to a scenario where there is convergence to the same long-run steady-state growth rate, but to different levels of per-capita income (Barro 1991; Mankiw, Romer, and Weil 1992). It should be noted that, even with relatively strong conditional convergence, absolute divergence may persist, particularly if conditioning variables such as physical and human investment rates are functionally related to income levels.

Many of the key features of endogenous growth theory are also found in the new economic geography theory, which developed formal models that emphasize the role of spatial concentration, specialization and other endogenous processes that promote productivity growth within particular regions and localities (Krugman 1991, 1998; Krugman and Venables 1995). Patterns of growth within the regions are shaped by structural variables such as market size, specialized labor markets, and knowledge based external economies. Collectively, these theories would predict a tendency towards divergent regional per-capita income levels and growth rates, being dependent on inherited or acquired structural characteristics, and reinforced by immobility in production inputs. These conclusions emerge even more directly in explanations of patterns of growth and development that incorporate the idea of cumulative causation.[2] Here, for example, the ability of regions to absorb technological advances is strongly dependent on existing levels of industrial development and concurrent human resource qualities. Therefore, in the absence of countervailing tendencies, divergence is a likely outcome. Moreover, the cumulative causation literature, while not denying the significance of technological issues and technical innovation, emphasizes the often intangible, though significant, role social and institutional factors play in shaping the often-diverging patterns of growth and development amongst nations and regions. This also raises the question as to the role governments can play in shaping this process, given that they have the capacity to influence the properties and values of some of the key structural factors that shape the convergence process.

One of the shortcomings of many of the approaches to analyzing per capita income disparities and convergence is that very little attention has been given to the likelihood of spatial interaction in the progress of output per worker, overlooking the likelihood that regions neighboring rich regions grow faster than its neighboring poorer regions (Rey 2001). This introduces the notion that the frequency with which one location may transition across differences in the per-capita income distribution may be spatially dependent, with observations for one location tending to reflect values similar to those in neighboring locations. For example, it may be the case that the significance of technological spillovers on the convergence rate may be greater if there is a higher degree of spatial interaction. Recent developments in spatial econometrics have provided regional convergence studies with modeling techniques incorporating spatial auto-correlation or neighborhood effects in which spatial dependence and heterogeneity can be investigated, alongside other significant determents of per-capital income heterogeneity and convergence.[3] In this setting, the modeling in this paper will utilize the spatial Durbin econometric model (SDM) to isolate the (direct and indirect) short and longer-run effects of fiscal decentralization on regional convergence, from which some useful policy implications can be drawn.

The paper is organized as follows. Section 2 provides an overview of investigations into the relationships between fiscal decentralization and its relationship with convergence. Section 3 outlines the methodology to be followed in the econometric modelling developed in this paper, with the main results presented in Section 4. The findings will be summarized in the concluding section, which will also consider some important implications and limitations associated with the empirical analysis presented in the paper.

2. Literature review

Fiscal centralization can be defined as the devolution or reassignment of specific powers from central government to subnational governments which are autonomous within their own geographic and functional spheres of authority (Faguet 2014). It has been argued that fiscal decentralization has the potential to raise the efficiency of government in general, and also to contribute to convergence in regional per-capita income levels (Oates 2005; OECD 2009, 2014; Blöchliger, Bartolini, and Stossberg 2016). Because decentralization allows local governments to play an active role in managing local economic development, territorial competition presents an opportunity for poorer regions, and can be a means of diversifying development strategies that would benefit local economies (Ezcurra and Pascual 2008; Canaleta, Pascual, and Rapún 2004). Similarly, it is contended that by transferring accountability to subnational governments, incentives are generated to engage actively in the process of innovations in the production and supply of public goods and services considering the preferences of the local population (Blöchliger, Bartolini, and Stossberg 2016). The consequence would be lower production costs and prices of public goods and services, along with better quality in the long run (Martinez-Vazquez and McNab 2003). Technological changes have also made it somewhat easier than before to provide public services (like electricity and water supply) relatively efficiently in smaller market areas, and in a world of rampant ethnic conflicts and separatist movements, decentralization is also regarded as a way of diffusing social and political tensions and ensuring local cultural and political autonomy

Conversely, it can be argued that the alternative policy of financing regional growth initiatives through intergovernmental grants may tend to fuel disparities on the grounds that they discourage the lagging regions from developing their economic and fiscal base. Similarly, central government's pursuit of traditional industrial policies may often be biased in favor of the most highly performing industries; industries that are more likely to be located in more developed higher per-capita income regions (Bardhan 2002). On the other hand, the major constraints on the ability of less developed low per capita income regions to realize the potential gains from decentralization during the initial stages would include the lack of sufficient localized physical and human capital and institutional settings and a narrow revenue base from which local governments and their agencies can draw upon.

There have been a large number of studies that investigate the relationship between fiscal decentralization and output per capita within nations and regions; however, a positive association in this context does not provide a definitive indication about convergence. This is because fiscal decentralization would actually increase regional inequality if the impact is greater in richer states than in the poor ones. The studies that have investigated the convergence issue directly have taken on a number of different forms, in part reflecting the different theoretical perspectives referred to above. A particularly extensive study was undertaken by Blöchliger, Bartolini, and Stossberg (2016), where bivariate and multivariate analysis indicated that, while across the OECD (1995–2012) GDP per capita was converging, regional disparities – or differences in GDP per capita across jurisdictions was rising mainly as a result of widening productivity differences. Importantly, the decentralization of own-source revenue and taxing power to sub-national governments is associated with convergence of regional GDP per capita in a country, and the vertical fiscal imbalance (the difference between a sub-national government's own revenue and its spending, generally covered by intergovernmental transfers) was detrimental to regional convergence. Causality tests suggested that it is the intergovernmental fiscal framework that affects regional convergence, rather than the other way round. Importantly, poorer regions benefit more from decentralization than richer ones.

Similar results have emerged from modelling undertaken by Bartolini, Stossberg, and Blöchliger (2016), who found that subnational governments that rely on their own resources, rather than transfers from the central government, tend to allocate more spending to economic rather than social areas (i.e. local policies related to investment and the business environment), while Kappeler et al. (2013) show that higher tax decentralization is associated with a shift of local spending towards investment in infrastructure and education. In an earlier investigation, Ulrich Thießen (2003) reported that with respect to the high-income OECD countries, the long-run empirical relationship between per capita economic growth, capital formation and total factor productivity growth, and fiscal decentralization, was positive when fiscal decentralization is increasing from low levels, but then reaches a peak and turns negative. In their study of 24 OECD countries, Kyriacou, Muinelo Gallo, and Roca-Sagalés (2015) found that fiscal decentralization promotes regional convergence in high government quality settings but, significantly, tended to lead to wider regional disparities in countries with poor governance. More recently, in their modeling of the Canadian fiscal equalization system, Hailemariam and Dzhumashev (2019) concluded that fiscal equalization lowers the speed of cross-regional convergence in real gross domestic product per worker, with fiscal equalization payments having a significant negative effect on the share of productive expenditures and a significant positive effect on the share of unproductive government expenditures.

Most of the studies linking regional convergence with fiscal decentralization have used data sets from high per-capita income nations, with little attention in the literature being devoted to low-income and emerging economies. A recent interesting example in this setting is evidence presented in Ganaie et al. (2018) examination of the relationship between fiscal decentralization and economic growth in the case of India, using panel data for 14 states for the period 1981–2014 (using panel cointegration, and dynamic ordinary least squares). The results from this study were somewhat ambiguous, with spending decentralization having a positive and significant impact on the state domestic product, while revenue decentralization had a significant negative effect. Lozano-Espitia and Julio (2016) found evidence for positive effects of fiscal decentralization on regional economic growth in Colombia since the enactment of the Political Constitution of 1991, while Bartlett, Dulic, and Kmezic (2018) also concluded that local economic development was enhanced by fiscal decentralization in the case of Serbia. Yushkov (2015) reported that in the case of regions in Russia (2005–2012), 'excessive' expenditure decentralization within the region, not accompanied by a significant level of revenue decentralization, had a significant negative impact on regional economic growth; however, regional dependence on intergovernmental fiscal transfers from the federal center was positively associated with economic growth.

Clearly, from the above discussion, it can be seen that the empirical evidence on the links between fiscal decentralization and regional per-capita income convergence remains somewhat inconclusive. This in turn reflects the widely different methods of empirical analysis and choice of control variables included in the modelling. Different measures of fiscal decentralization are also found in the analysis. In order to reach a consensus on the decentralization-convergence question, further studies are required, particularly in relation to low income and emerging economies. It is in this context that Vietnam provides a particularly interesting case study, together with an opportunity to apply spatial econometric modeling, as outlined in the following section.

3. Methodology

3.1. The model

This section develops a spatial panel data model to investigate the effects of fiscal decentralization on regional income convergence in Vietnam. Unconditional and conditional convergence can be defined as follows:

Unconditional convergence:

$$\ln\left(\frac{y_{i,\ t}}{y_{i,\ t-1}}\right) = \alpha_i + \beta \ln(y_{i,\ t}) + \ \varepsilon_t, \tag{1}$$

Conditional convergence:

$$\ln\left(\frac{y_{i,\ t}}{y_{i,\ t-1}}\right) = \ \alpha_i + \beta ln(y_{i,\ t}) + \gamma X_{i,t} + \ \varepsilon_t, \tag{2}$$

where:$y_{i,t}$ indicates the capita per income of province i at time t;$X_{i,\ t}$ is a list of the control variables in the Solow model including capital and labor inputs

ε_t is the error term with zero mean.

Unconditional convergence is implied if β in Equation (1) is found to be significant and negative. If the parameter β in Equation (2) is significant and negative, the presence of unconditional beta-convergence is suggested (Barro 1992).

Traditionally, regional income convergence has been modeled in the following general framework:

$$y_t = X_t \beta + \varepsilon_t \tag{3}$$

where y_t is a n x 1 (column) vector of dependent variables (regional income), and X_t is a n x k matrix of regressors which include indictors of fiscal decentralization.

However, from our discussion in Section 2, we need to allow for the possibility that regions may be correlated with neighboring regions in two respects. First, it is likely that the value y_t in a particular region is related to the value of y_t in neighboring regions. Second, the value of the regressors included X_t may be related between regions. There are a number of alternative spatial panel data models which allow for a consideration of one or both of these regional interdependencies; including, for example, spatial autoregressive models (SAR), spatial Durbin models (SDM), spatial error models (SEM), spatial autocorrelation models (SAC) and spatially lagged X models (SLX). A common feature of these models is the inclusions of a n x n matrix, denoted W, representing the spatial relationships between regions, where each entry w_{ij} €W represents the spatial weights associated to units i and j (Belotti, Hughes, and Mortari 2017). Dynamic versions of some of these models can be constructed with the inclusion of lagged dependent variables, and in some instances, lagged explanatory variables.

In this study, the spatial Durbin model (SDM) has been selected to capture the spatial interrelationships between regions. The SDM takes on the following general form:

$$y_t = \rho W y_t + X_t \beta + W Z_t \theta + \mu_t + \varepsilon_t \tag{4}$$

where ρ indicates how much, if any, the income (y_t) in region i is affected by the level of y_t in neighboring regions; $X_t\beta$ captures the effects of own values of explanatory variables on y_t in each region; $WZ_t\theta$ indicates how neighboring values of the explanatory variables impact on y_t in each region, with θ reflecting the strength of that relationship. The error terms μ_t and ε_t are assumed to be normally distributed, except in the case where we do not have random effects in the data, in which case μ_t is a vector of estimated parameters.[4]

As noted above, the W matrix is a n x n spatial weight matrix, normalized in such a way that the elements of each column sum to one. Therefore, column normalization allows a measure of the impact of each province on all other provinces (Elhorst 2014b). In this case study of Vietnam, we use a measure of neighborliness which uses a population weighted geographical distance matrix, consisting of a row-standardized weight matrix, computed on the k-nearest provinces based on the distance among provincial administrative centers (provincial capitals) (Baicker 2005; Case, Rosen, and Hines 1993; Gallo and Ertur 2003). The k-nearest provinces are weighted by their own population size as geographical units, allowing for the fact that greater influence may occur in the case of those with similar demographic characteristics (in this study, the 63 nearest provinces are considered). This type of matrix is preferred over contiguity and adjacent neighbors due to the presence of islands in the sample and the possibility of selecting the same number of neighbors for each province (Siano and D'Uva 2014).

The SDM has been selected largely because its spillover effects are more flexible in comparison to the often-used SAR, SLX, SAC and SEM alternatives, where restrictions are imposed on the more general SDM framework. In the case of the SAR model, for example, θ is set equal to zero, implying that y_t values are not directly influenced by the values of explanatory variables in neighboring regions. The SAC extends the SAR model by allowing for a spatially autocorrelated error, while the SEM is a special case of the SAC which effectively sets $\theta = -\rho\beta$. Similarly, the SLX model restricts the SDM by setting $\rho = 0$.[5] Rather than imposing these types of restrictions in the modeling developed here, the more general SDM is seen to be more appropriate when considering the complexities of regional income convergence. The SDM, which contains both a spatially dependent variable and spatially independent variables, is also able to distinguish between direct effects (the influence of a particular explanatory variable on the dependent variable) and indirect effects termed partial spillovers. Importantly, the SDM lends itself to a dynamic specification, where the lagged dependent variable (in time and space) is added to the model:

$$y_t = r y_{t-1} + \omega W y_{t-1} + \rho W y_t + X_t \beta + W Z_t \theta + \mu_t + \varepsilon_t \tag{5}$$

To examine the impact of fiscal decentralization on income convergence, fiscal decentralization variables are added directly to the model SDM:

$$\begin{aligned} \ln\left(\frac{y_{i,\ t}}{y_{i,\ t-1}}\right) &= \delta Wln(y_{i,t-1}) + \alpha_i + \beta ln(y_{i,\ t}) \\ &\quad + \gamma FD_{i,t} + \theta WFD_{i,t-1} + \rho X_{i,t} + \lambda WX_{i,t} + u_i + \tau_t + \varepsilon_t, \end{aligned} \tag{6}$$

where: $y_{i,t}$ indicates the capita per income of province i at time t;

W is the normalized element weight matrix for neighborliness.
$FD_{i,t}$ is the fiscal decentralization indicator of the province I, at time t.
$X_{i,\ t}$ is a list of the control variables.
u_i is a spatial specific effect controlling for time-invariant variables.
$\tau_t$is a time-specific effect accounting for spatial-invariant variables.

A traditional simple Swan-Solow type relationship is nested within the SDM framework, which incorporates labor and capital inputs as control variables within the X matrix. Given data limitations, factor inputs will be indicated by working age population and physical investment activity. Attention is now focused on the measures of fiscal decentralization to be included in equation (6).

3.2. Measuring fiscal decentralization

There are a variety of ways in which fiscal decentralization has been defined and measured in the literature, with either expenditure or revenue dimensions, or a combination of both, employed (Oates (1972), Zhang and Zou (1998), Davoodi and Zou (1998), Yilmaz (1999), Lin and Liu (2000), Akai and Sakata (2002), Yushkov (2015). The most often used measures of decentralization include the ratio of regional revenues to total government revenues (Akai and Sakata 2002; Wu and Heerink 2016); the ratio of self-generated regional revenues to total regional revenues (Yushkov 2015; Vo 2009) and the ratio of regional expenditures to total government expenditures (Akai and Sakata 2002; Wu and Heerink 2016). Regional expenditure and revenue ratios are often adjusted to exclude defence and social security expenditures, and grants-in-aid as a component of total government revenues.

In this study, the fiscal decentralization is measured in three ways. The first two correspond to the frequently used measures noted above. The third is an 'enhanced' index of fiscal decentralization, the derivation and properties of which are discussed below.

1. FD1: Local Revenue/(Total local Revenue + Central revenue)
2. FD2: Local Expenditure/(Total local expenditure + central expenditure)
3. FD3: Enhanced index of fiscal decentralization (eFD)

The reliability of the commonly used measures, FD1, and FD2, has been questioned, as there appears to be a gap between 'measurement' and 'theory'. In addition, as highlighted by D. H. Vo (2010), these measurements do not consider the autonomy of regional government in their fiscal activities (in terms of investment behaviour). Vo developed two new indicators for measuring the degree of fiscal decentralization to address some of these issues. The enhanced fiscal decentralization index [eFD] developed by Vo takes account of the fiscal autonomy of the regional authority. The index also considers the effects on fiscal autonomy of unconditional grants and borrowings by regional authorities. The enhanced index of fiscal decentralization is identified as follows:

$$\mathbf{eFD} = \sqrt{\frac{\mathrm{OSR}}{\mathrm{E}} + \left(\frac{\mathrm{TU}-\mathrm{TC}}{\mathrm{E}} \times \frac{\mathrm{TU}}{\mathrm{T}}\right)) \times \frac{\mathrm{E}}{\mathrm{TE}}}$$

Where, for each of the provinces:OSR: represents for the owned source revenue for subnational regionE: the expenditure of regional governmentsTU: *Unconditional transfers* from the central government to the regional government.TC: *Conditional transfers* from the central government to the regional government.T: total transfers (= $\mathrm{T_U}$ + $\mathrm{T_C}$)TE: Total public sectors expenditure which is equal to total regional expenditure plus total central expenditure. Total expenditure (TE) does not include fiscal transfers from one level government to another (for example, a fiscal transfer from a central authority to the regional authority.

From these equations, the key ratios can be defined as follows:

OSR/E represents the share of sub-national expenditure that is funded by regional own-sourced revenue, which is known as the 'fiscal autonomy' of regional governments.

E/TE: the share of total public-sector expenditure undertaken by regional governments, known as the "fiscal importance" of regional governments.

TU − TC, is the net unconditional transfer which is the difference between the unconditional and conditional fiscal transfer to regional governments.

(TU − TC)/E, is the share of regional expenditure funded by net fiscal transfers, called the fiscal transfer share.

Revenue and expenditure statistics are collected from the annual budget of the Ministry of Finance, with descriptive statistics for the fiscal variables shown in Appendix A. All three of the fiscal decentralization indicators, FD1, FD2, FD3, will be included in the SDM estimations summarized in the following section.

4. Empirical results

The final results derived from the SDM outlined in Section 3 are summarized in this section. The empirical analysis will use province-level spatial panel data from 64 Vietnam provinces over the period from 2005 to 2017. Data on macroeconomic indicators, including GDP at constant (2010) prices, investment, population and workforce details is taken from the General Statistics Office of Viet Nam (GSO) and the Statistical Yearbook of Vietnam. Data used to construct the three indicators of fiscal decentralization is collected from the Ministry of Finance annual budgets. This data includes total local budget expenditures (E), total local budget revenues (R), and decentralized revenue (OSR), conditional transfers (TC) and unconditional transfers (TU), and total expenditure (TE) and revenue (TR) of the 64 provinces. Descriptive details of the fiscal variables are provided in Appendix A. The Hausman test has been used to differentiate between fixed effects model and random effects, as reported in Appendix B. Acceptance of the null hypothesis of random effects is rejected if the p-value is less than 0.05. The results reported in Table 1, exclude those which are found to be insignificant in accordance with the Hausman's specification test.

First. the static and dynamic versions of the SDM are estimated for both conditional and unconditional convergence, prior to the addition of the fiscal decentralization variables. The dynamic version of the model includes the lagged change in the log of real output. From Section 3, we recall the following definitions of conditional and unconditional convergence:unconditional convergence:

$$\ln\left(\frac{y_{i,\ t}}{y_{i,\ t-1}}\right) = \delta Wln(y_{i,t-1}) + \ \alpha_i + \beta ln(y_{i,\ t}) + \ u_i + \ \tau_t + \ \varepsilon_t, \tag{8}$$

conditional convergence:

$$\ln\left(\frac{y_{i,\ t}}{y_{i,\ t-1}}\right) = \delta Wln(y_{i,t-1}) + \ \alpha_i + \beta ln(y_{i,\ t}) + \ \rho X_{i,t} + \lambda WX_{i,t} + \ u_i + \ \tau_t + \ \varepsilon_t, \tag{9}$$

Table 1. Summary of the final results from the SDM model.[a]

	Static model					Dynamic model				
		Conditional convergence					Conditional convergence			
VARIABLES (1)	Unconditional convergence (2)	Non FD (3)	With FD1 (4)	With FD2 (5)	With FD3 (6)	Unconditional convergence (7)	Non FD (8)	With FD1 (9)	With FD2 (10)	With FD3 (11)
L.delta_lny						0.7870***	0.8249***	0.7204***	0.7731***	0.7796***
						(0.027)	(0.028)	(0.027)	(0.028)	(0.028)
lny	−0.409***	−0.379***	−0.529***	−0.430***	−0.423***	−0.0325	−0.010	−0.100***	−0.061***	−0.053**
	(0.020)	(0.020)	(0.018)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.021)	(0.021)
FD			−3.0721***	−7.6949***	−7.3637***			−2.0488***	−4.0060***	−3.9680***
			(0.282)	(0.920)	(0.921)			(0.232)	(0.769)	(0.760)
gi		0.0004	0.0005*	0.0003	0.0003		0.0004	0.0004*	0.0003	0.0003
		(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
rlabour		−0.0054***	−0.0053***	−0.0052***	−0.0051***		−0.0008	−0.0017**	−0.0010	−0.0008
		(0.001)	(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)	(0.001)
wlny	−0.0867	−0.141**	0.218***	−0.038	−0.050	−0.126**	−0.147***	−0.042	−0.110**	−0.119**
	(0.058)	(0.059)	(0.053)	(0.059)	(0.059)	(0.052)	(0.052)	(0.053)	(0.054)	(0.053)
wFD			4.8607***	3.7888	3.4357			2.1511**	0.3864	−1.5482
			(1.028)	(3.458)	(3.461)			(0.952)	(2.825)	(2.786)
wgi		−0.0007	0.0004	−0.0010	−0.0010		0.0021**	0.0017**	0.0018**	0.0017**
		(0.001)	(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)	(0.001)
wrlabour		0.0084***	0.0082***	0.0084***	0.0084***		0.0040***	0.0052***	0.0041***	0.0040***
		(0.002)	(0.002)	(0.002)	(0.002)		(0.001)	(0.001)	(0.001)	(0.001)
rho	0.6356***	0.6215***	0.7172***	0.6389***	0.6383***	0.0784	0.0524	0.1723**	0.0765	0.0668
	(0.071)	(0.070)	(0.068)	(0.069)	(0.069)	(0.068)	(0.067)	(0.067)	(0.068)	(0.068)
sigma2_e	0.0180***	0.0171***	0.0159***	0.0157***	0.0158***	0.0109***	0.0103***	0.0090***	0.0098***	0.0098***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Speed of convergence	0.5266	0.4766	0.7529	0.5625	0.5503	0.0330	0.0102	0.1056	0.0630	0.0549
Half-life	1.316	1.454	0.921	1.232	1.260	20.979	68.281	6.565	10.994	12.631
Observations	756	756	756	756	756	693	693	693	693	693
R-squared	0.911	0.524	0.846	0.587	0.584	0.913	0.919	0.927	0.919	0.914
Number of id5	63	63	63	63	63	63	63	63	63	63
AIC	−599.70	−890.77	−740.12	−954.17	−948.71	−1217.96	−1244.6	−1335.4	−1278.1	−1277.5
BIC	−571.90	−853.75	−684.58	−907.89	−902.43	−1195.26	−1203.7	−1285.4	−1228.2	−1227.5

Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

[a]These estimates were generated by the Stata; a useful commentary on spatial econometric modelling generated by Stata, together with the underlying assumptions, can be found in Belotti, Hughes, and Mortari (2017).

Table 2. Variable descriptions.

Variable	Description
lny	log of per-capita income at constant prices
L.delta_lny	lagged value of the change in lny
FD1	Local Revenue/ (Total local Revenue + Central revenue)
FD2	Local Expenditure / (Total local expenditure + central expenditure)
FD3	The enhanced index of fiscal decentralization developed by D.H. Vo (Equation (3) in section 2)
gi	growth in (physical) investment
rlabour	working age population
wFD, wgi, wrlabour	spatial variables reflecting magnitudes in neighboring provinces for FD, gi and rlabour
rho	Scalar spatial autoregressive coefficient (Spearman's rho rank-order correlation coefficient)
sigma2_e	variance indicator
Speed of convergence	−ln(1 + beta)
Half-life index	−ln (2)/ ln(1 + beta)
R-squared	traditional 'goodness of fit' measure
Number of id5	number of provinces in the sample
AIC	Akaike Information Criterion for model selection
BIC	The Bayesian information Criterion for model selection

where: $y_{i,t}$ indicates the capita per income of province i at time t; W is the normalized element weight matrix for neighborliness; $X_{i,t}$ is a list of the control variables; u_i is a spatial specific effect controlling for time-invariant variables; τ_t is a time-specific effect accounting for spatial-invariant variables. Variable descriptions are provided below in Table 2.

From this model, it is also possible to calculate the speed of convergence, which refers to how rapidly an economy's per capita income (or more precisely, output per effective worker) approaches its steady state.[6] Based on this value, the so-called half-life can be computed, i.e. the time span which is necessary for current disparities to be halved (see for example, Arbia and Piras 2005). These indicators are traditionally defined as follows:

$$\text{convergence index} \ = -\ln(1+\beta)$$

$$\text{half} - \text{life index}: \ \ln\ (2)/\ln(1+\beta)$$

The estimates are reported in columns (2) and (7) in Table 1. The three alternative fiscal decentralization [FD] variables are then added to the spatial regression model, with the results included in the adjacent columns. It can be observed that the estimated β coefficient for the lny variables has the expected negative sign and is statistically significant in all of the estimated models. These results indicate evidence of both conditional and unconditional convergence in Vietnam, consistent with a number of previously reported studies (see, for example, Công and Hưng 2014; Le and Nguyen 2018; Bentzen and Tung 2020; Minh and Khanh 2013; Vu, Hoang, and Nghiem 2018). It is also noted that the wny coefficient, reflecting the interaction of neighboring province per-capita real income, is statistically significant in all but one of the alternative specifications of the dynamic version of the SDM. Importantly, it can be observed that all three of the fiscal decentralization variables contribute significantly to the process of income convergence over the period. The input control variables representing capital and labor inputs yield somewhat diverging estimates and levels of significance across the models, suggesting a need for further consideration of the way in which these variables are traditionally defined and measured within these types of models. The, at times ambiguous results, also reflect complications arising from factor mobility between sectors, which may cloud the distinction between location of employment and residence.

In terms of model selection, Spearman's rho rank-order correlation coefficient suggests that the static model is preferred to the dynamic model, while model selection based on the Akaike Information Criterion (AIC) and Bayesian information criterion (BIC) is more supportive of the dynamic versions of the model.[7] The sigma2_e results are supportive of the conclusion that approximately 95% of the population lies within two standard deviations of the mean for each of the alternative models.

As noted above, we can calculate the convergence index $-\ln(1+\text{beta})$ from the coefficient β. The larger the index, the quicker is the movement towards convergence for all localities. The half-life index, calculated by $-\ln(2)/\ln(1+\text{beta})$ provides an indication of the time it takes to close the gap between rich and poor between localities. From Table 1, it can be observed that the speed of convergence increases when fiscal decentralization indices are added to the models. The results also indicate that the effect of the time variable on income convergence is significant and should be taken into account in the analysis of the components of convergence. Finally, it can be seen that the types of fiscal decentralization appear to have different effects on convergence. Notably, budget decentralization, measured by the share of local autonomy revenue resources in total national revenues, accelerates income convergence to a greater extent than the expenditure decentralization and integrated decentralization indicators developed by D.H. Vo (2010).

If we focus attention on the dynamic SDM (i.e. including the lagged dependent variable), it is possible to distinguish between direct and indirect sources of convergence amongst the regions, and also to differentiate between short- and long-term effects. Direct effects encompass changes in local independent variables, as well as the feedback effects arising from local independent variables impacting on adjacent provinces. Indirect effects show the impact on the expected value of province i, given a change in the explanatory variable in province j. The total impact measures the impact of the same unit change in province i, averaged over all states. Direct effects should be used to test the hypothesis as to whether a particular variable has a significant effect on the dependent variable in its own economy rather than the coefficient estimate of that variable. Similarly, indirect effects should be used to test whether or not spatial spillovers exist rather than the coefficient estimate of the spatially lagged dependent variable and/or the coefficients estimates of the spatially lagged independent variables.

The inclusion of the lagged dependent variable in the dynamic SDM also enables a distinction to be made between short- and long-term effects (Elhorst 2014a, 106). Short-term effects are computed as partial derivatives of lny with respect to an explanatory variable at a particular point in time. Long-term term effects are computed in the same manner, with the added restriction that $\ln y_{i,t-1} = \ln y_t = \ln y_t^*$, where $\ln y^*$ can be interpreted as being similar to a steady-state where lny remains constant in all provinces. The relevant lny (beta) coefficients are shown in Table 3,

Table 3. Dynamic SDM: Marginal effects and convergence.

		Dynamic model				
		Unconditional convergence	Conditional convergence			
			Non FD	With FD1	With FD2	With FD3
Long-term	Direct	−0.171*	−0.077	−0.379***	−0.285 ***	−0.257 ***
		(0.093)	(0.116)	(0.072)	(0.093)	(0.095)
	Indirect	−0.433***	−0.566 **	−0.307 ***	−0.382 ***	−0.397 ***
		(0.114)	(0.237)	(0.116)	(0.115)	(0.116)
	Total	−0.604***	−0.643 **	−0.686 ***	−0.666 ***	−0.654 ***
		(0.142)	(0.272)	(0.144)	(0.141)	(0.141)
Short-term	Direct	−0.033*	−0.011	−0.101 ***	−0.062 ***	−0.054 ***
		(0.020)	(0.019)	(0.020)	(0.021)	(0.020)
	Indirect	−0.070 ***	−0.079 ***	−0.034	−0.063 **	−0.067 **
		(0.025)	(0.026)	(0.028)	(0.027)	(0.027)
	Total	−0.103 ***	−0.090 ***	−0.135 ***	−0.125 ***	−0.121 ***
		(0.027)	(0.027)	(0.028)	(0.027)	(0.027)
Speed of Convergence						
Long-term	Direct	0.1880	0.0802	0.4758	0.3349	0.2965
	Indirect	0.5667	0.8349	0.3669	0.4808	0.5067
	Total	0.9266	1.0306	1.1577	1.0972	1.0619
Short-term	Direct	0.0341	0.0109	0.1067	0.0639	0.0557
	Indirect	0.0726	0.0824	0.0349	0.0653	0.0697
	Total	0.1093	0.0942	0.1455	0.1336	0.1294
	Indirect	9.551	8.412	19.860	10.617	9.949
	Total	6.344	7.358	4.764	5.186	5.356
	Observations	693	693	693	693	693
	R-squared	0.913	0.919	0.927	0.919	0.914
	Number of id5	63	63	63	63	63

Standard errors in parentheses,
***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

which also includes indicators of the speed of convergence [-ln(1 + beta] derived from these estimates. These indicators provide further insights as to the extent to which fiscal decentralization accelerates movements towards income convergence amongst the provinces.

The results summarized in Table 3 suggest that fiscal decentralization has contributed to a faster acceleration towards the steady-state or income convergence, both in the short and long run. More generally, the results suggest that fiscal decentralization has increased income convergence significantly in the case of each of the indicators of fiscal decentralization considered. Likewise, the indirect (spillover) results indicate that fiscal decentralization has an influence on the neighboring province's per capita income, beyond that which can be accounted for by geographic proximity.

5. Concluding comments

This paper has investigated the role fiscal decentralization may have played in the process of regional per capital income convergence within Vietnam. A variety of theoretical and empirical approaches have been discussed in Sections 1 and 2 of the paper, with each emphasizing different aspects of the convergence process. The empirical modelling developed here was based on the spatial Durbin model, augmented to incorporate alternative definitions of fiscal decentralization. Spatial econometric models, that include lags of the dependent variable and of the independent variables in both space and time provide, enable the investigator to isolate potential dynamic adjustments to the decentralization process.

The results reported in this paper are subject to the usual caveats related to data quality and availability, and also interpretations of econometric modeling; however, they suggest that fiscal decentralization has played a significant role in accelerating the process of regional per capital income convergence in Vietnam, and will continue to do so into the future. These results are largely consistent with a small number of similar studies from different countries as discussed in the paper; however, only a limited number of these studies cover emerging economies that are undergoing significant fiscal reform. While these reforms may not be solely based on the objective of regional income convergence, this may be a significant outcome to be considered by policy makers

It will be interesting to observe if the results reported in this paper are replicated in further empirical modelling encompassing different data sets and statistical techniques. Other factors such as the quality of governance may also have been playing an important role in this process (see Thanh, Hart, and Nguyen 2020). The significance of indirect effects on convergence that appear to be stimulated by fiscal decentralization is also of interest, warranting further investigation. More generally, income inequality remains a challenging issue for policymakers to resolve, and if regional disparities can be reduced in part through fiscal decentralization, this is a significant finding for policy formulation.

Notes

1. Gill and Kharas (2007) introduced the term 'middle-income trap' to describe selected East Asian economies that had not reached high-income level status by the 2000s despite their remarkable growth rates in the previous decades
2. This literature stems largely from the contributions of Myrdal (1957) and Kaldor (1966, 1981), while the various notions of endogenous growth are discussed in Roberts and Setterfield (2007). Bhattacharjea (2009) summarizes some of the key characteristics. Economic geographers such as Martin and Sunley (1996) have been critical of the neglect of historical, cultural and institutional considerations in the formal models of spatial agglomeration that dominate economic growth literature.
3. The development of spatial econometrics largely evolved from the work of Paelinck (1978) and Paelinck and Klaassen (1979). Useful overviews of the development and application of these techniques can be found in Rey (2001), Anselin (2010) and Lesage and Fischer (2008), while specific studies are referred to in Section 4 of this paper.
4. The fixed effect assumption is that the individual-specific effects are correlated with the independent variables. When some effect in a statistical model is modeled as being random, we mean that we wish to
draw conclusions about the population from which the observed units were drawn, rather than about these particular units themselves. The Hausman test is used to determine if there are fixed or random effects in the data. See discussion below in Section 4 and Appendix B.
5. The alternative spatial models can be expressed as follows:
SLX: $X_t\beta + WZ_t\theta + \mu_t + \varepsilon_t$
SAR: $\rho Wy_t + X_t\beta + \mu_t + \varepsilon_t$
SAC: $\rho Wy_t + X_t\beta + \mu_t + \Pi_t$, where $\Pi_t = hM\Pi_t + \varepsilon_t$

SEM: $X_t\beta + \mu_t + \Pi_t$, where $\Pi_t = hM\Pi_t + \varepsilon_t$
Where M is a matrix of spatial weights which may differ from W.
6. For discussion of the steady-state equilibrium interpretation, see Lesage and Fischer (2008).
7. The usual "rule" for comparing two or more models is to choose the one with the minimum AIC or BIC value. For example, if Model 1 has an AIC value of -50.5 and Model 2 has an AIC value of −100.5, then Model 2 offers a better fit. It doesn't matter if both AIC values are negative.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix A: Descriptive statistics for fiscal variables

Variable	Descriptive	Obs	Mean	Std. Dev.	Min	Max
R	Local revenue	756	10706.6	32198.9	45.0	347882.0
E	The expenditure of regional governments	756	5293.5	7404.8	338.2	79545.1
OSR	The owned source revenue for subnational region	756	3782.8	7396.8	48.0	75845.1
TU	Unconditional transfers from the central government to the regional government.	756	1506.7	1676.2	0.0	14301.7
TC	Conditional transfers from the central government to the regional government	756	803.5	610.6	50.0	7377.3
T	Total transfers	756	2309.4	2103.9	50.0	16238.7
TR	Total revenue	756	674513.0	301915.0	249542.2	1192306.0
TE	Total expenditure	756	384356.5	197272.1	126984.5	743080.2

Appendix B: The results of the estimator by static spatial durbin models with random and fixed effects

VARIABLES	REM-FD1	FEM-FD1	REM-FD2	FEM-FD2	REM-FD3	FEM-FD3
lny	−0.5290***	−0.4451***	−0.5440***	−0.4302***	−0.5442***	−0.4232***
	(0.018)	(0.019)	(0.021)	(0.020)	(0.022)	(0.020)
FDj	−3.0721***	−3.4870***	−6.1142***	−7.6949***	−5.7551***	−7.3637***
	(0.282)	(0.278)	(0.930)	(0.920)	(0.932)	(0.921)
Gi	0.0005*	0.0005*	0.0003	0.0003	0.0003	0.0003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
rlabour	−0.0053***	−0.0058***	−0.0045***	−0.0052***	−0.0044***	−0.0051***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wlny	0.2184***	0.0243	0.1974***	−0.0383	0.2002***	−0.0497
	(0.053)	(0.057)	(0.056)	(0.059)	(0.057)	(0.059)
wFD_j	4.8607***	3.0309***	11.9511***	3.7888	11.1837***	3.4357
	(1.028)	(1.168)	(2.806)	(3.458)	(2.812)	(3.461)
wgi	0.0004	−0.0008	0.0008	−0.0010	0.0010	−0.0010
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wrlabour	0.0082***	0.0094***	0.0067***	0.0084***	0.0064***	0.0084***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
rho	0.7172***	0.6940***	0.6506***	0.6389***	0.6489***	0.6383***
	(0.068)	(0.068)	(0.071)	(0.069)	(0.072)	(0.069)
lgt_theta	−1.2490***		−1.0359***		−1.0002***	
	(0.177)		(0.219)		(0.236)	
sigma2_e	0.0159***	0.0140***	0.0183***	0.0157***	0.0185***	0.0158***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.1420***		0.1444***		0.1391***	
	(0.042)		(0.046)		(0.044)	
LR_Direct_lny	−0.5393***	−0.4622***	−0.5530***	−0.4471***	−0.5530***	−0.4404***
	(0.017)	(0.018)	(0.020)	(0.019)	(0.021)	(0.019)
LR_Indirect_ lny	−0.1405***	−0.2415***	−0.1282***	−0.2522***	−0.1250***	−0.2575***
	(0.019)	(0.020)	(0.021)	(0.021)	(0.022)	(0.021)
LR_Total_ lny	−0.6799***	−0.7037***	−0.6812***	−0.6993***	−0.6780***	−0.6979***
	(0.016)	(0.014)	(0.016)	(0.014)	(0.016)	(0.014)
Observations	756	756	756	756	756	756
R-squared	0.846	0.646	0.863	0.587	0.863	0.584
Number of id5	63	63	63	63	63	63
AIC	−740.12	−1032.90	−664.10	−954.17	−657.08	−948.71
BIC	−684.58	−986.62	−608.56	−907.89	−601.54	−902.43
Hausman test	Ho: difference in coefficients not systematic					
	chi2(9) = 10.88		chi2(9) = 28.31		chi2(9) = 27.28	
	Prob> =chi2 = 0.2843		Prob> =chi2 = 0.0008		Prob> =chi2 = 0.0013	

Standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$